The Genomics of Naturopathic Medicine

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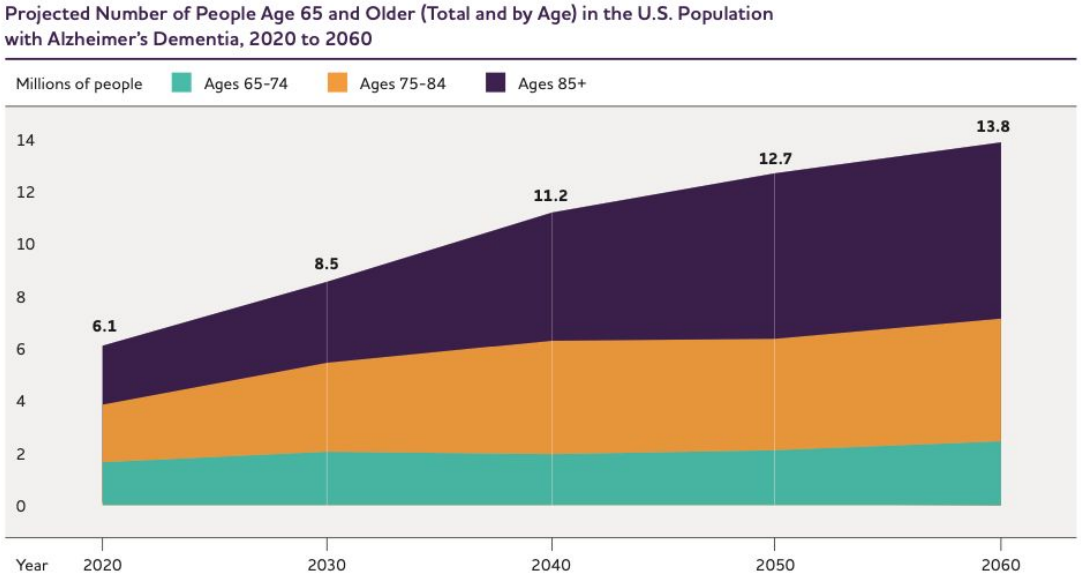
The Problem

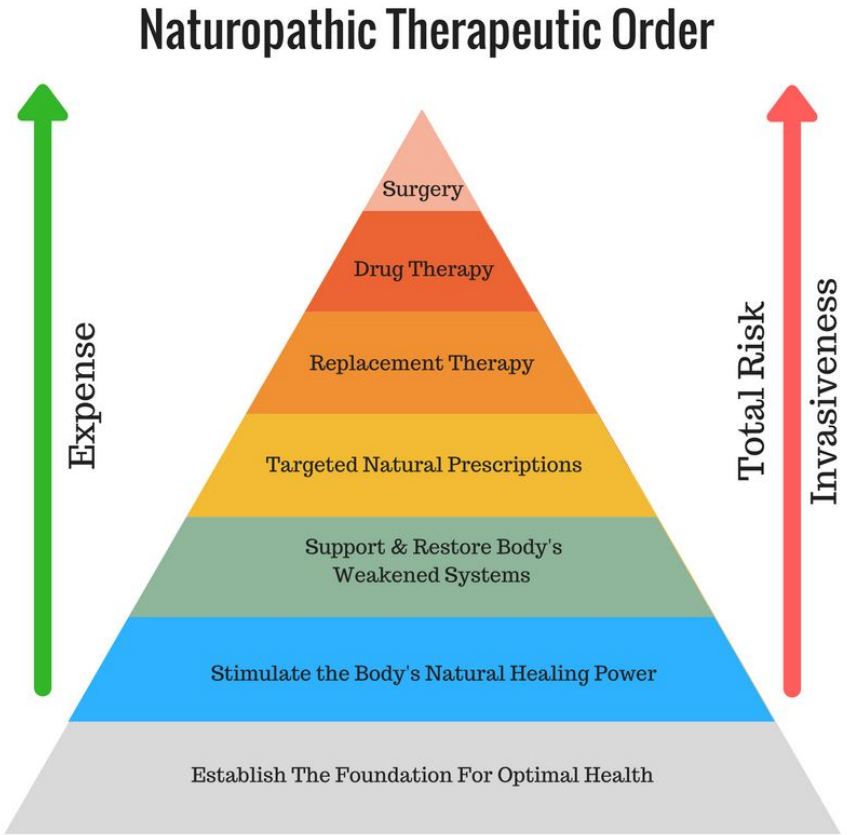


- Declared a Federal Problem
- Today nearly 7 million Americans live with Alzheimer's
- Cost of yearly care is 360 Billion USD
- By 2050 nearly 13 million could be living with Alzheimer's

Why Conventional Medicine Lead to this Problem

- A systemic brief consultation
- Fails to address root cause
- Alzheimer’s is a systemic multifaceted issue
- Naturopathic Medicine is the scientific solution

The Full Spectrum Therapeutic Order Found in Naturopathic Medicine



Premise

- Higher inflammatory biomarkers = Higher neuro inflammation = Faster progression of potential Alzheimer's Disease

- Higher oxidative stress biomarkers = Higher neurotoxicity = Faster progression of potential Alzheimer's Disease

- High unhealthy biomarkers are just fuel for disease

Proposal

- How does Naturopathic Medicine and Traditional Chinese Medicine herbs, such as Danggui Shaoyao San and Rhodiola Rosea, affect the gut microbiome and this colonic and overall gene expression, to reduce or prevent the progression of Alzheimer’s disease and its pathologies?

Dataset 1

- Hundreds of biomarker measurements over 3 main groups
- DSS: Mice induces with Alzheimer's that receive the herb Danggui Shaoyao San
- M: Mice induced with Alzheimer's that receive no Danggui Shaoyao San
- Con: Control group

Dataset 2

- 20+ biomarker measurements over Braak Stage groups

- Braak Stage 0: Mice with early Alzheimer's
- Braak Stage I-II: Mice with somewhat progressed AD
- Braak Stage III-IV: Mice with later AD
- Braak V-VI: Mice with late AD

Dataset 3

- Gene expression measurements
- Reference gene + Inflammatory Liver markers

- Mice treated with herb Rhodiola Rosea or water

- Lower gene expression ratio = Lower inflammatory markers

- Crp Liver ct / GADPH Ct Liver

Dataset 4

- RNA colonic gene expression measurements of mice
- Many different genes
- Higher values = higher expression

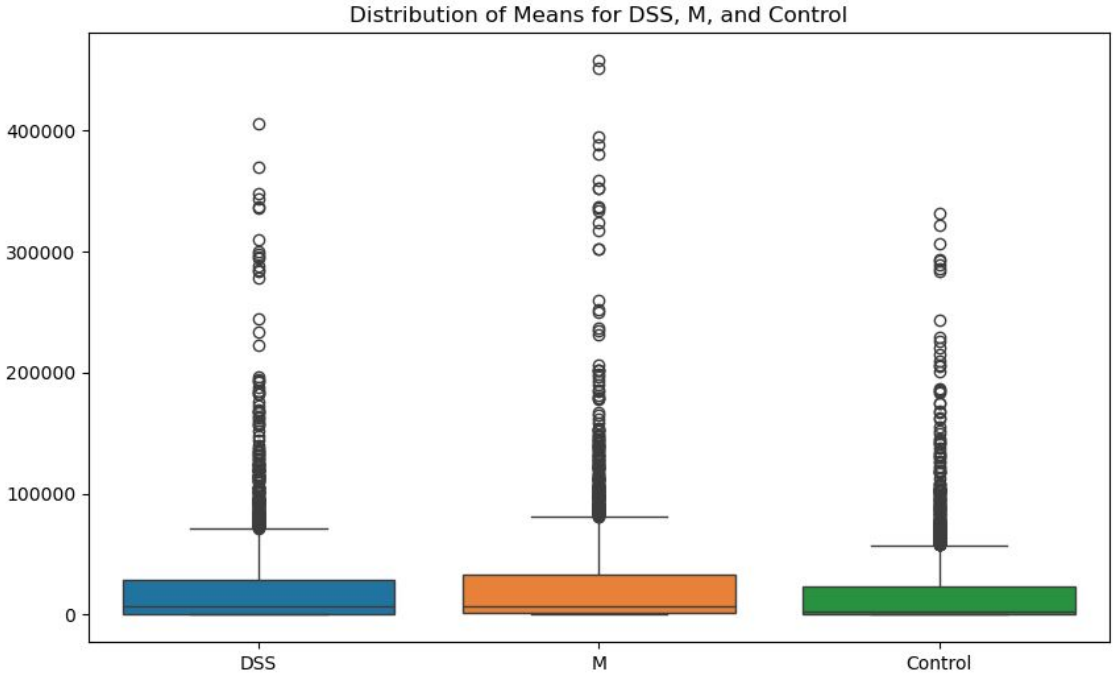
Results

- Dataset 1: *DSS reduces and prevents Alzheimer's pathology.*

- *All of the oxidative stress biomarker averages, and std deviations for the DSS test group are lower than the M group that did not receive DSS even tho both groups are induced with Alzheimer's.*

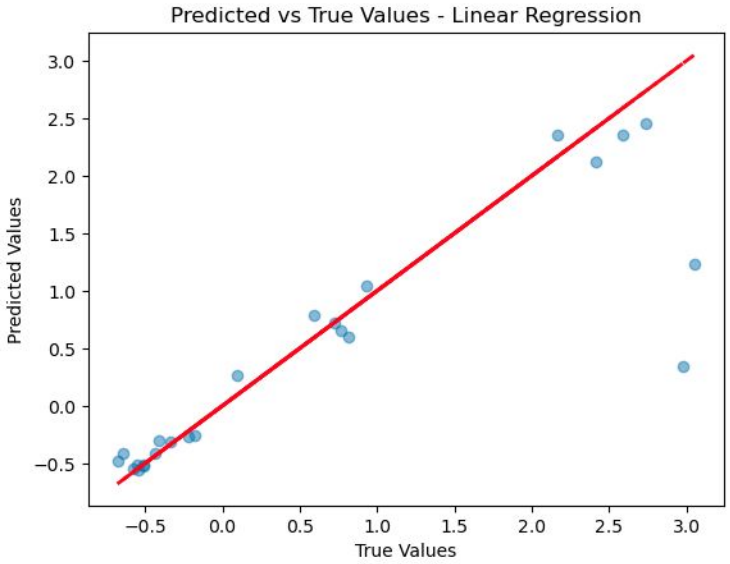
	mean_DSS	std_DSS	mean_M	std_M
1	3826.833333	4733.886457	5489.978	8955.680670
2	5796.226667	5804.802297	8678.71	8993.934839

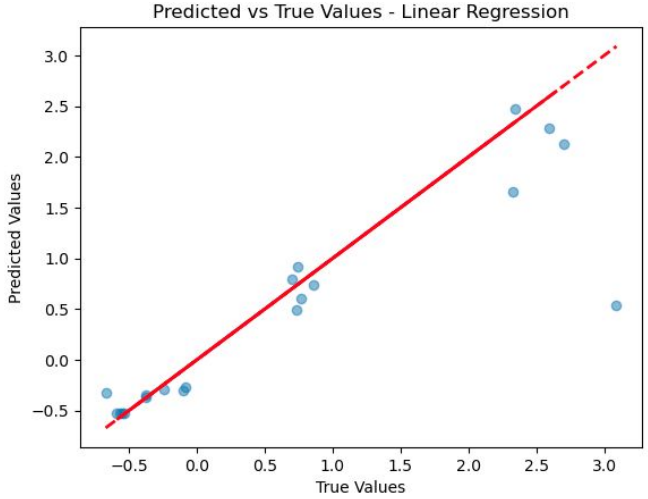
Results


Distribution of Means for DSS, M, and Control
400000
300000
200000
100000
0
DSS
M
Control

Results

- Left: predicting the DSS group's "Oxidative Stress "biomarker values from the control group's "Oxidative Stress" biomarker values. Right: Predicting the M group's "oxidative stress" biomarkers from the control group.





Results

- *There is a strong prediction correlation that Danggui Shaoyao San group's "Oxidative Stress Biomarkers" from Control group's "Oxidative Stress" Biomarker values.*

```
Ridge Regression - MSE: 0.450383366427147, R²: 0.7834837150701227
Lasso Regression - MSE: 0.4501992680261535, R²: 0.783428920085136
```

- *There are stronger predictions correlation for the M Group "Oxidative Stress Biomarkers" from Control group's "Oxidative Stress" Biomarker values.*

```
Ridge Regression - MSE: 0.3853119825593684, R²: 0.8103255706541118
Lasso Regression - MSE: 0.38531875048730824, R²: 0.8101734616377823
```

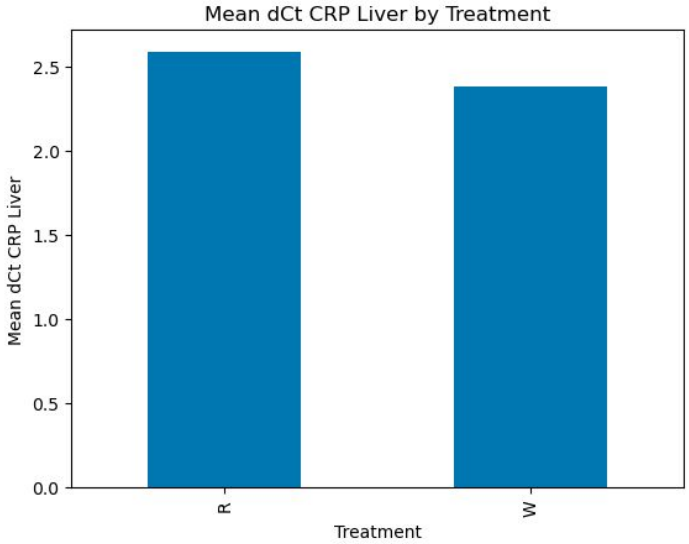
Results

- Dataset 2: *Any level of Alzheimer's is markedly similar to early and later stage progression of biomarkers.*
- *Null hypothesis rejected*

```
R Group - Pearson Correlation: -0.6267056150840675, P-value: 0.18301400349578048
W Group - Pearson Correlation: -0.31276776715263405, P-value: 0.4506831691999088
```

Results

Dataset 3: *Statistically water seemed more effective than Rhodiola in showing a smaller amount of liver inflammation*



Results

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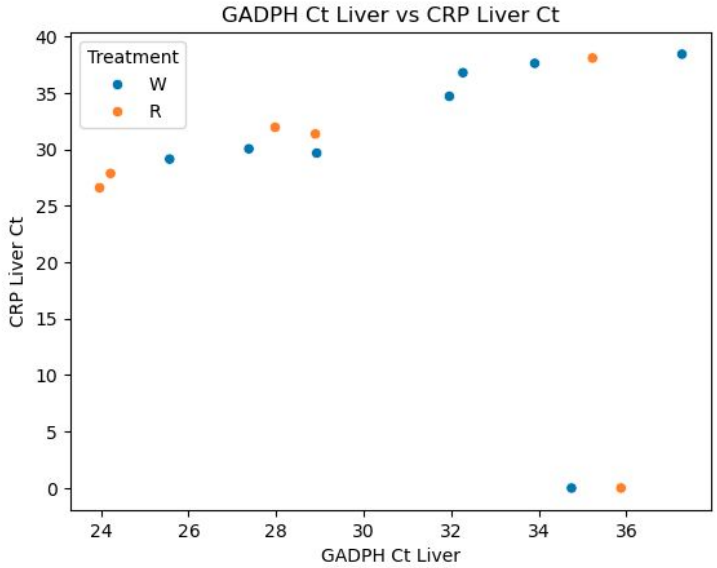

Results

- Dataset 3: *Rhodiola Rosea is efficacious in preventing AD, as seen in this machine learning algorithm.*
- *Lower liver inflammation ratio is associated with higher chances mice were treated with Rhodiola versus water.*

```
Cross-validation accuracy scores: [0.33333333 0.66666667 0.66666667 0.33333333 0.5       ]
Mean cross-validation accuracy: 0.5
Logistic Regression Coefficients: [[-0.05081321]]
Intercept: [-0.28783944]
A lower liver ratio is associated with a higher likelihood of Treatment 'R'
```

Results

- Dataset 4: *Same highest expressed genes,*
- *Different lowest expressed genes which presumably are related to age. Age feature missing.*

	Highest Expressed Gene	Highest Value	Lowest Expressed Gene	Lowest Value
GSM3101204	10593865	14.093398	10340611	1.901215
GSM3101205	10593865	14.161691	10343775	1.913130
GSM3101206	10593865	14.200280	10342725	1.797553
GSM3101207	10593865	14.144030	10343254	1.916115
GSM3101208	10593865	14.090882	10341558	1.874138

Recommendations

The study above proves that DSS is more efficacious in preventing Alzheimer's pathology than Rhodiola Rosea is. It is recommended that supplementation with this herbal concoction over Rhodiola Rosea with the guidance of a Traditional Chinese Medicine Practitioner or Naturopathic Doctor, be given serious thought if Alzheimer's is prevalent in one's family.

Supplement companies could market DSS as an anti-neurodegenerative supplement based on the research of the studies above, and even promote a Danggui Shaoyao San supplement as anti-Alzheimer's to whatever legal limits they are able to based on the regulating bodies of their country.